

CLAIMS:

1. A pressurized steam jetting nozzle comprising a tubular nozzle holder having on one end a pressurized steam inlet opening to be connected with a pressurized steam supply tube, on another end a steam outlet opening to be connected with a steam discharge tube of an outside, and an opening elongating along a longitudinal direction of a lower surface thereof, and

a nozzle member disposed detachably on the lower surface of the nozzle holder and having a plurality of nozzle holes formed so as to face the opening.

2. The pressurized steam jetting nozzle according to claim 1, wherein the tubular nozzle holder is a cylindrical nozzle holder.

3. The pressurized steam jetting nozzle according to claim 1 or 2, wherein a cylindrical filter capable of eliminating minute foreign substances included when steam is introduced is disposed on a same axis as that of an inside of the nozzle holder.

4. The pressurized steam jetting nozzle according to any of claims 1 to 3, wherein the opening formed in the lower surface of the nozzle holder is a slit like opening formed continuously in a longitudinal direction of the nozzle holder.

5. The pressurized steam jetting nozzle according to any of claims 1 to 3, wherein the opening formed in the lower surface of the nozzle holder comprises small holes formed zigzag in a

longitudinal direction of the nozzle holder.

6. The pressurized steam jetting nozzle according to any of claims 1 to 5, wherein the nozzle holder has a drainage outlet opening in a lower part thereof.

7. The pressurized steam jetting nozzle according to any of claims 1 to 6, wherein the nozzle holder has a drainage outlet opening on one end thereof, and the nozzle holder is inclined upward with respect to a horizontal line with a drainage opening side end part provided as a base end.

8. The pressurized steam jetting nozzle according to claim 1, wherein the nozzle member comprises a nozzle plate having a plurality of nozzle holes and a plate supporting member for supporting the nozzle plate, and the nozzle holes have tubular holes.

9. The pressurized steam jetting nozzle according to claim 8, wherein the nozzle holes are disposed in a plurality of rows in a width direction of the nozzle plate.

10. The pressurized steam jetting nozzle according to claim 8 or 9, wherein a shape of each of the tubular holes is cylindrical.

11. The pressurized steam jetting nozzle according to any of claims 8 to 10, further comprising a continuous groove part having an inverse trapezoidal cross section continuous in a longitudinal direction of the nozzle plate in an upper end of the tubular hole of each of the nozzle holes.

12. The pressurized steam jetting nozzle according to any of claims 8 to 10, further comprising an inverse truncated conical hole on an upper end of the tubular hole having a cylindrical shape.

13. The pressurized steam jetting nozzle according to any of claims 10 to 12, wherein a value of a ratio of a tubular hole height to an inner diameter is set at 1 to 2.

14. The pressurized steam jetting nozzle according to claim 8, wherein each of the nozzle holes has a ring piece elongating concentrically from a lower end circumferential rim of each of the tubular holes into a hole opening.

15. The pressurized steam jetting nozzle according to any of claims 8 to 14, wherein a plate thickness of the nozzle plate is 0.5 to 1 mm.

16. The pressurized steam jetting nozzle according to claim 15, wherein a steam jetting opening inner diameter of each nozzle hole is 0.05 to 1 mm, and a pitch between nozzles is 0.5 to 3 mm.

17. The pressurized steam jetting nozzle according to claim 1, wherein the nozzle member comprises a single member having a ship like recessed groove part communicating with a lower end opening of the nozzle holder, a rectangular cross section groove part formed along a ship bottom part of the recessed groove part, a plurality of inverse truncated conical holes formed by a predetermined pitch along a longitudinal

direction of the rectangular cross section groove part, and cylindrical holes formed continuously on lower ends of the inverse truncated conical holes.

18. The pressurized steam jetting nozzle according to claim 17, wherein a lower end face shape in a width direction of the nozzle member is provided as a curved surface shape projecting downward.

19. The pressurized steam jetting nozzle according to claim 17 or 18, wherein a value of a ratio of a cylindrical tubular hole height to an inner diameter is set at 1 to 2.

20. The pressurized steam jetting nozzle according to claim 18 or 19, wherein a steam jetting opening inner diameter of a nozzle hole is 0.05 to 1 mm, and a pitch between nozzles is 0.5 to 3 mm.

21. A production method for a nonwoven fabric of entangling constituent fibers by continuously jetting pressurized steam along a width direction of a fiber web running in one direction from a plurality of nozzle holes, using a pressurized steam jetting nozzle comprising a tubular nozzle holder having on one end a steam inlet opening to be connected with a pressurized steam supply tube, on another end a steam outlet opening to be connected with a steam discharge tube of an outside and an opening elongating along a longitudinal direction of a lower surface thereof, and a nozzle member disposed detachably on the lower surface of the nozzle holder

and having a plurality of nozzle holes formed so as to face the opening, the method comprising steps of:

initially introducing pressurized steam from the steam inlet opening, discharging the pressurized steam from the steam outlet opening to the outside;

measuring a temperature inside the pressurized steam jetting nozzle;

stopping a discharge of the steam by switching a steam outlet path to a drainage eliminating path via a trap at a time the temperature inside the nozzle reaches at a predetermined temperature;

running a fiber web continuously in a state facing the jetting nozzle holes of the nozzle after a stoppage of the discharge of the steam so as to entangle fiber web constituent fibers by the pressurized steam jetted from the jetting nozzle holes; and

vacuuming the steam passing through the fiber web by vacuuming means so as to discharge the same to the outside at an opposite side of the fiber web with respect to the jetting nozzle holes.

22. The production method for a nonwoven fabric according to claim 21, comprising a step of discharging drainage produced inside the nozzle holder from a drain outlet opening formed in a lower part of the nozzle holder to the outside.

23. The production method for a nonwoven fabric according

to claim 21 or 22, comprising steps of disposing the nozzle holder inclined upward by a desired angle with its one end part provided as a base end toward another end, and discharging the drainage produced inside the nozzle holder from a drainage outlet opening formed in the one end part to the outside.

24. The production method for a nonwoven fabric according to any of claims 21 to 23, comprising a step of entangling the constituent fibers of the fiber web also from a steam reflecting plate side by reflecting the steam immediately after the steam passes through the fiber web by a steam reflecting plate having a plurality of openings.

25. The production method for a nonwoven fabric according to any of claims 21 to 24, comprising a step of maintaining a temperature of the pressurized steam jetting nozzle at a saturated steam temperature of the steam to be used or higher under a heated atmosphere.

26. The production method for a nonwoven fabric according to claim 25, comprising a step of forming the heated atmosphere by an introduction of hot air.

27. The production method for a nonwoven fabric according to claim 21, comprising steps of disposing the pressurized steam jetting nozzle so as to face an upper surface of a running fiber web and jetting the pressurized steam toward the upper surface of the fiber web.

28. The production method for a nonwoven fabric according

to claim 21 or 27, comprising a step of disposing the pressurized steam jetting nozzle so as to face a lower surface of the running fiber web and jetting the pressurized steam toward the lower surface of the fiber web.

29. The production method for a nonwoven fabric according to any of claims 21 to 28, comprising a step of clamping and transporting the fiber web between a porous fiber web supporting and transporting member and a porous pressing and transporting member.

30. The production method for a nonwoven fabric according to claim 29, comprising a step of setting an interval between a steam jetting side end part of a pressurized steam jetting nozzle and the fiber web pressing and transporting member at 0 to 30 mm or less.

31. The production method for a nonwoven fabric according to claim 29 or 30, comprising a step of reciprocally moving a fiber web supporting and transporting member and the fiber web pressing and transporting member or the pressurized steam jetting nozzle in a direction traversing a fiber web transporting path.

32. The production method for a nonwoven fabric according to any of claims 21 to 31, comprising steps of temporarily storing the pressurized steam in a steam storage part disposed in a halfway of the pressurized steam supply tube and discharging dusts in the steam stored in the steam storage part

to the outside together with condensed liquid, and

introducing the pressurized steam passing through the steam storage part to one end of the pressurized steam jetting nozzle.

33. The production method for a nonwoven fabric according to claim 32, comprising a step of producing superheated steam by further heating pressurized supplied steam in the pressurized steam supply tube between the steam storage part and the pressurized steam jetting nozzle.

34. The production method for a nonwoven fabric according to claim 33, wherein steam pressure introduced to the pressurized steam jetting nozzle is 0.1 to 2 MPa, and steam jetted from the pressurized steam jetting nozzle is the superheated steam.

35. The production method for a nonwoven fabric according to any of claims 21 to 34, wherein a pre-process for temporarily fixing a shape is conducted prior to a fiber entanglement by jetting the steam.

36. The production method for a nonwoven fabric according to claim 35, wherein the pre-process includes a supply of moisture.

37. The production method for a nonwoven fabric according to claim 35, wherein the pre-process includes thermally fusing at least a part of constituent fibers of a fiber web.

38. A production apparatus for a nonwoven fabric by



entangling constituent fibers by jetting pressurized steam from a plurality of nozzle holes formed in a longitudinal direction of a pressurized steam jetting nozzle to a running fiber web facing thereto, the apparatus comprising:

a pressurized steam supply source connected with one end of the pressurized steam jetting nozzle via a pressurized steam supply tube;

a steam discharge tube connected with another end of the pressurized steam jetting nozzle via an opening/closing valve;

porous fiber web supporting and transporting means facing the plurality of the nozzle holes formed in the pressurized steam jetting nozzle by a predetermined interval and moving in one direction across a row of the nozzle holes of the pressurized steam jetting nozzle; and

vacuuming means disposed on an opposite side of the pressurized steam jetting nozzle with respect to the fiber web supporting and transporting means.

39. The production apparatus for a nonwoven fabric according to claim 38, wherein the pressurized steam jetting nozzle is the pressurized steam jetting nozzle according to any of claims 1 to 20.

40. The production apparatus for a nonwoven fabric according to claim 38 or 39, wherein an entirety of the pressurized steam jetting nozzle is heated in a hot air atmosphere.

41. The production apparatus for a nonwoven fabric according to claim 39, comprising a drainage discharging opening in a lower part of a nozzle holder of the pressurized steam jetting nozzle.

42. The production apparatus for a nonwoven fabric according to claim 39, comprising a drainage discharging opening on one end of a nozzle holder of the pressurized steam jetting nozzle, and the nozzle holder is inclined upward with a drainage outlet side end part as a base end toward an opposite side end part.

43. The production apparatus for a nonwoven fabric according to any of claims 38 to 42, wherein a steam reflecting plate is further disposed between the fiber web and the vacuuming means.

44. The production apparatus for a nonwoven fabric according to claim 38 or 39, wherein the pressurized steam jetting nozzle is disposed above the running fiber web.

45. The production apparatus for a nonwoven fabric according to claim 38 or 44, wherein the pressurized steam jetting nozzle is disposed below the running fiber web.

46. The production apparatus for a nonwoven fabric according to any of claims 38 to 45, wherein a fiber web transporting means comprises the porous fiber web supporting and transporting means disposed between the nozzle holes of the pressurized steam jetting nozzle and the fiber web, and porous

fiber web pressing and transporting means for clamping the fiber web with respect to the fiber web supporting and transporting means for transporting the fiber web in cooperation with the fiber web supporting and transporting means.

47. The production apparatus for a nonwoven fabric according to claim 46, further comprising reciprocally moving means for reciprocally moving the pressurized steam jetting nozzle or the fiber web supporting and transporting means and the fiber web pressing and transporting means in a direction traversing a fiber web transporting path.

48. The production apparatus for a nonwoven fabric according to claim 47, wherein the fiber web supporting and transporting means and the fiber web pressing and transporting means comprise a pair of upper and lower porous endless belts to be driven and rotated synchronously with each other, and

vacuuming means is disposed at a portion facing nozzle holes of the pressurized steam jetting nozzle inside either of the endless belts with a slit like vacuuming opening directed toward the endless belt.

49. The production apparatus for a nonwoven fabric according to claim 46 or 47, wherein one of the fiber web pressing and transporting means and the fiber web supporting and transporting means comprises an endless belt to be driven and rotated, and another one of them comprises a porous rotary drum to be driven and rotated synchronously with the endless belt,

and vacuuming means is disposed at a portion where the endless belt and the rotary drum are disposed most adjacently, with a slit like vacuuming opening directed to an inside of the endless belt or the rotary drum.

50. The production apparatus for a nonwoven fabric according to claim 46, comprising gap adjusting means for adjusting a gap between the nozzle holes of the pressurized steam jetting nozzle and the fiber web supporting and transporting means and/or the fiber web pressing and transporting means.

51. The production apparatus for a nonwoven fabric according to claim 46 or 50, further comprising gap adjusting means for adjusting a transporting interval between the fiber web pressing and transporting means and the fiber web supporting and transporting means.

52. The production apparatus for a nonwoven fabric according to claim 38, wherein a steam storage part is disposed in a conduit of the pressurized steam supply tube.

53. The production apparatus for a nonwoven fabric according to claim 52, wherein heating means is disposed in a conduit of the pressurized steam supply tube between the steam storage part and one end of a pressurized steam jetting nozzle.

54. The production apparatus for a nonwoven fabric according to claim 38, comprising a trap conduit branched from a conduit of the steam outlet tube between the opening/closing

valve and another end of the pressurized steam jetting nozzle.

55. The production apparatus for a nonwoven fabric according to any of claims 38 to 54, comprising pre-process means for temporarily fixing a shape on an upstream side from the pressurized steam jetting nozzle in a fiber web transporting direction.

56. The production apparatus for a nonwoven fabric according to claim 55, wherein the pre-process means is a moisture supplying device.

57. The production apparatus for a nonwoven fabric according to claim 55, wherein the pre-process means is a heating device for fusing at least a part of constituent fibers of a fiber web.